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**A TECHNIQUE OF GRAIN ORIENTATION  
FOR RADIOGRAPHIC ANALYSIS**

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The accurate examination of wheat or other grains for hidden infestation by the radiographic method requires a systematic arrangement of the kernels on the X-ray film. If random arrangements are used, considerable time may be consumed in reading the finished radiograph. Expensive films, chemicals, and more time may be wasted by too loosely grouping the kernels. At the other extreme, a crowded sample will produce results that make accurate evaluation impossible.

Various techniques have been suggested for orientation of the kernels of grain in preparation for the radiographic examination. A series of small lateral V-shaped furrows produced by crimping a heavy grade of Cellophane has been used. The lateral furrows are filled by sprinkling the sample of grain over them. A slight jar will upset the arrangement. Grooved plastic has been tried, but radiographic details in the sample are obscured by the X-ray's transversing the plastic. Assorted grills or pens have been used, but they too are tedious to load.

The soda-straw technique described herein has been found to be a very satisfactory method for conserving film as well as reducing the preparation and examination time of each sample. It also affords a convenient way of handling the grain samples for storage, identification, and reexamination at a later date, if this be desired.

Soda straws are inexpensive and can be obtained very easily in various diameters. The choice of diameter will depend on the kind of grain being examined. The common size 4 mm. in diameter is ideal for wheat kernels. Cellophane soda straws are more convenient to work with, since the tightness of the packed wheat kernels inside the straw can be observed; however, with a little experience comparable results can be obtained with paraffin paper straws.

Individual soda straws can be loaded with wheat kernels in about 2 seconds with the use of suction from a small vacuum pump or aspirator (fig. 1). A good holder for the straws can be quickly constructed from a 3-inch section of 5-mm. o.d. glass tubing having a wall thickness of 1.05 mm. A 1-inch section of light gum-rubber tubing 3/16 inch i.d.

is slipped 1/2 inch on one end of the section of glass tubing. The remaining 1/2-inch end of rubber tubing forms a receptacle cup for the soda straws. The other end of the section of glass tubing is connected to the vacuum line. The internal diameter of the glass tubing is small enough to prevent sucking wheat kernels down the vacuum line. The irregular shape and size of the wheat kernels make it impossible to clog the straw by reducing the vacuum during the loading operation. When the straw has been filled, it is removed from the receptacle cup and each end is crimped with the fingernail to confine the kernels. Each straw can be marked with ink or other method of identification.

A fully loaded 8 1/2-inch soda straw will hold about 45 wheat kernels. These kernels will remain in the same order until the straw is unloaded. One-hundred and forty-four of these soda straws, giving a total of 6,480 kernels, can be radiographed side by side in a grain X-ray machine on a 14- by 17-inch X-ray film (figs. 2, 3). Arrangement of the straws and the number of kernels radiographed per sample are of course optional. The loaded straws can be grouped with rubber bands and stored in 2-quart Mason jars or any convenient container.

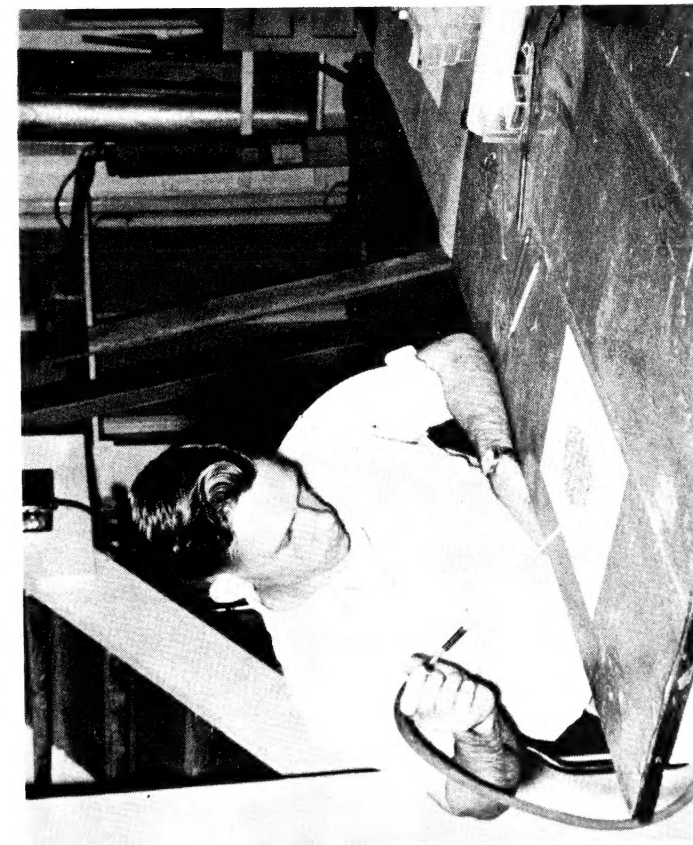


Figure 1.--Loading a soda straw. Note the suction line, glass tubing restricting the suction line, and the rubber receptacle for the straw.

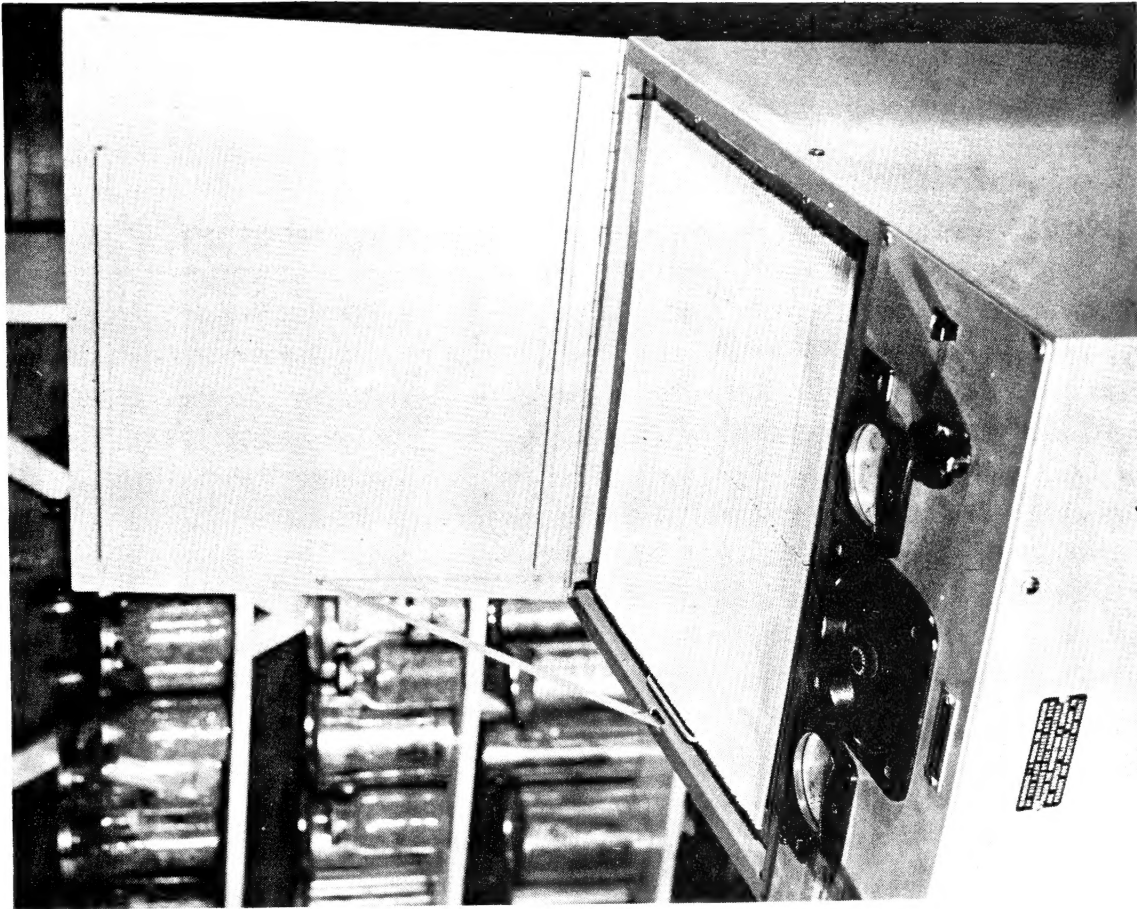


Figure 2.--Two rows of 144 soda straws arranged in place to cover the 14- by 17-inch radiograph rack of a grain X-ray machine.

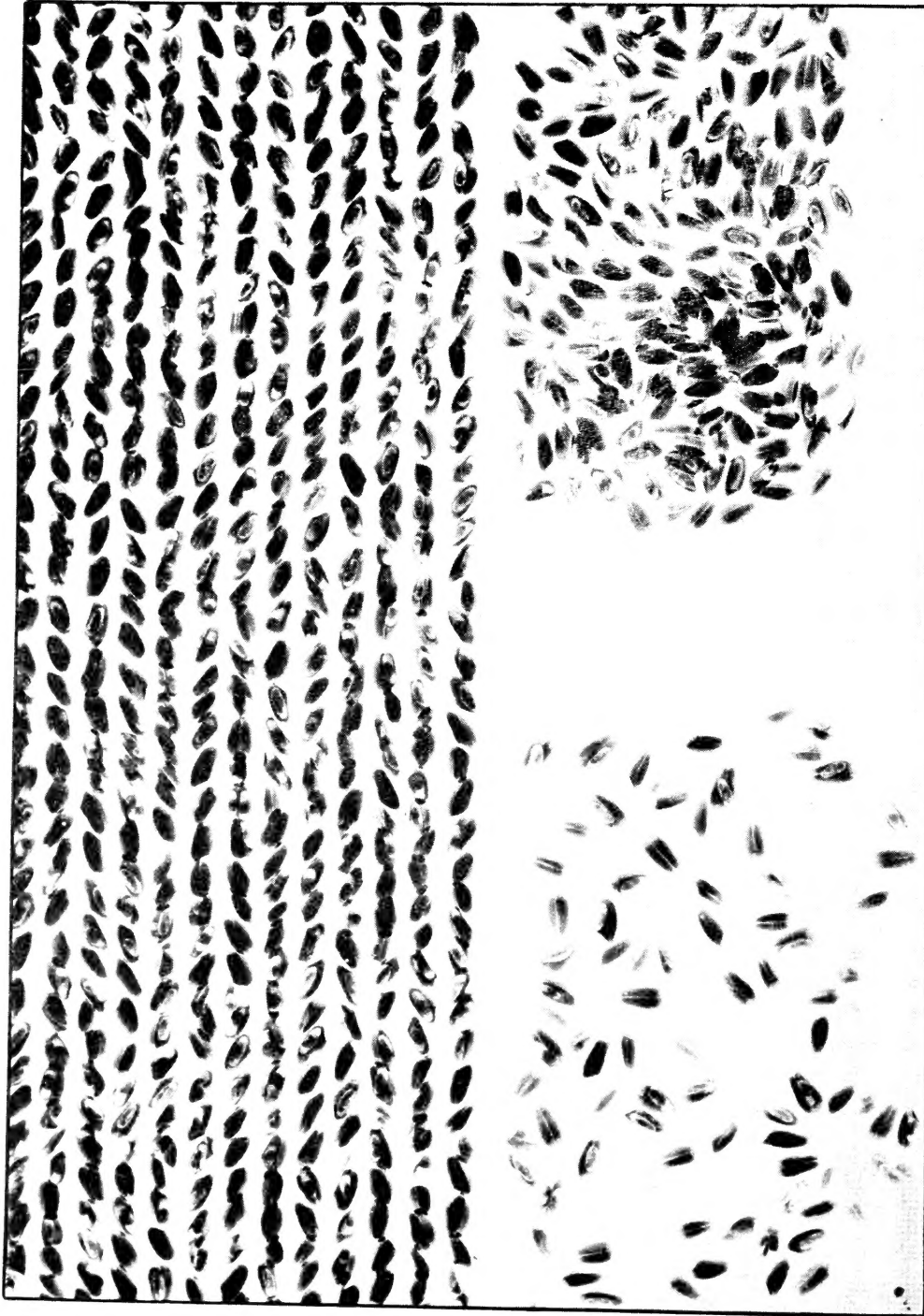


Figure 3.--Radiograph of infested wheat. Upper half, orientation with soda straws; lower right, a crowded random arrangement; lower left, a loose random arrangement.